

[10] The differences between data systems and file systems are especially significant with communication between computers and external networks. The structure of a network greatly increases the probability that a process will be interrupted, an issue that has grown in importance with the development of large computer networks such as the Internet.

[11] When data are transferred between computing devices they are typically received by **either** data system or file system software. Developers must choose between the advantages and disadvantages of each.

[12] There is a significant need for a system that overcomes the disadvantages of the prior art.

092828-1300

SUMMARY OF THE INVENTION

[13] The invention provides a method for managing a data system and a file system. The data system is a software program that processes and stores data and is designed to ensure the integrity of the data. Integrity includes file read consistency, prevention of dirty reads and dirty writes, and logging features that allow recovery from entire system failures. However, the cost of such integrity includes difficult management (especially of large data systems), large processor requirements, and the lack of management tools and filters. The file system is a software program that is designed to manage files quickly and with less processing power requirements, yet generally unable to ensure the integrity of data. By coordinating both the data system and the file system, the advantages of both can be used without suffering any significant disadvantages.

[14] The management system ensures that data from an external sources is first received by the data system. In so doing, the integrity of the data in maintained. Once received, the data is copied from the data system to the file system so the advantages of the file system can be exploited. Metadata is used to ensure data integrity is maintained during the copying of data from the data system to the file system and to describe and track the state and location of the data.

09728784-13000

09-06-2017

[16] FIG. 2 is a flowchart of a method for transferring data to a computer file system via intermediate storage in a data system.

[18] FIG. 4 is a flowchart of a method for copying or transferring files that may be stored on either a file system or a data system or both.

DETAILED DESCRIPTION OF THE INVENTION

[19] FIG. 1 shows the relationships between elements of the current invention and a computer network. A management system 110 supervises the functions of a data system 120 and a file system 130. Although the management system 110 can be an intrinsic part of a data system 120, created or modified just for the purpose of the invention, it is preferably overlaid on top of an existing commercial data system 120 as a component or an add-on. The different systems 110, 120 and 130 can receive digital data through a communications device 140 from external sources 150 such as a computing device 160 or a computer network 170.

[20] FIG. 2 illustrates how the invention processes data. In the first step 210 data is received by a communications device 140 from an external source 150. The data is then passed through to the data system 120 in the next step 220. It is essential to the invention that the data be delivered to the data system 120 or equivalent software because the integrity of the data must be ensured. If a problem is encountered in the data transfer, the state of the data system 120 must be able to be rolled back to the condition that existed prior to the initiation of the transfer. A record for the data is created during the step 220 of passing data to the data system 120. The record can include metadata, additional data that describes data or states of data, such as the data's title, creation date, and last modification date. Transferring data from the external source 150 to the data system 120 and creating data records are known in the current art.

[21] It is essential that some metadata, however, be associated with the data. Specifically, the required metadata must include state flags that are used to ensure the integrity of the data and describe and track the state of the data throughout its lifetime. As used in this specification, the term "state flag", whether singular or plural, means any method that can be used to describe the status of the data. State flags can refer to variables, binary switches, tables, organization or location of data, the absence of certain data, by reference to the time or some combination of these methods.

[22] Although it is preferred that the required metadata be maintained in the data system 120, there is no limitation to where the metadata is stored. It is essential, regardless of where the metadata is stored, that the management system 110 be able to access the information

within the metadata. The metadata can be used to make the specific workings of the invention transparent to the external sources 150.

[23] Initially, the state flags indicate that the data is found on the data system 120. Depending on the specific implementation of the invention, the state flags may also be used to indicate where other copies are located or that no other copies of the data exist.

[24] In the next step 240 the state flags are set to indicate that the transfer from the data system 120 to the file system 130 has been initiated. This flag is used to ensure that the transfer will meet selected ACID protocols with regard to the reading and writing of data so that no other transaction can cause interference. Considerable overhead reduction can be achieved by meeting only those ACID protocols required for this specific transfer ("minimum ACID protocols").

[25] The next step 250 then attempts to create a second copy of the data on the file system 130. If the copy is not successful the transfer can be retried or an error handling process can be initiated. Otherwise, state flags are set in the following step 260 to indicate that the transfer was successful. The utilities needed to perform the data transfer and confirm its success can be found in standard data systems 120 and file systems 130. The steps 240, 250, and 255 involved in copying the data from the data system 120 to the file system 130 can be performed at any time. Prior to creating a copy of the data on the file system 130, all requests to access the data from external sources must be either denied or directed to the data system 120. The management system 110, therefore, must be able to interpret the state flags and determine whether a copy of the data exists on the file system 130.

[26] Additionally, filters can be used whenever data is transferred to the file system 130. Filters can be used for authentication, decryption and encryption, command or syntax parsing, interpretation, compilation, type/format conversion, access control, security, and the detection of undesirable code such as virus and system commands. If filters are desired, they can be implemented before or during the step 250 of copying the data to the file system 130.

[27] In order to free memory, the data can be deleted from the data system 120. Although these steps 270, 280, 285, and 290 can be performed immediately, after a certain period of time has passed, at an arbitrary time, or after selected events have occurred, such as backups.

[33] If the deletion is unsuccessful, it can be reattempted or an error handling routine can be invoked. Otherwise, state flags are set to indicate that the process is complete. In the final step 360 the entire data system record associated with the data, including metadata, is optionally deleted. This deletion may be delayed or omitted for backup, logging, or other tasks.

[34] FIG. 4 shows the steps involved in a file copy or file transfer process. A file copy may, for example, be used in file backup operations. The first step 400 of the process can be performed immediately on request, after a certain period of time has passed, once a backup has been performed, or after other specified events. In the next step 410 the state flags are examined to determine where copies of the data reside. Possibilities of where the data could reside include the file system 130 and the data system 120. If copies of the file are not found the process can be terminated or passed on to an error handler step 420. Otherwise, a state flag is set in step 430. In the next step 440 the transfer is attempted. If the transfer is not successful it can be reattempted or the process can be passed to an error handler. If the transfer is successful a flag is set in step 450 to indicate completion. If the process was a file transfer, (copy followed by deletion of the original) a file deletion process (See FIG. 3) is initiated in step 460.

[35] The above description is of illustrative embodiments of the present invention. As these embodiments of the present invention are described with reference to the aforementioned illustrations, various modifications or adaptations of the methods and or specific structures described may become apparent to those skilled in the art. All such modifications, adaptations, or variations that rely upon the teachings of the present invention, and through which these teachings have advanced the art, are considered to be within the

07-26-84 1100